

Name \_\_\_\_\_

Date \_\_\_\_\_

## 291 Compound Interest (Chapter 10)

When interest is compounded continuously, we use the formula:

$$A = Pe^{rt}$$

Where  $P$  is the principal,  $r$  is the interest rate, and  $t$  is time in years.

When interest is compounded  $n$  times a year, we use the formula:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

Where  $P$  is the principal,  $r$  is the interest rate,  $n$  is the number of times compounded in a year, and  $t$  is the number of years the investment will grow into the amount  $A$ .

1. How long will it take a \$1000 investment to triple in value if it is invested at an annual rate of 12% compounded quarterly?

$$3000 = 1000 \left(1 + \frac{.12}{4}\right)^{4t}$$

$$3 = 1.03^{4t}$$

$$\log 3 = 4t \log 1.03$$

$$9.13 = 4t$$

about  
9 1/4 yrs

2. How much money must be invested at 16% compounded quarterly, to yield \$10,000 at the end of 5 years?

$$10,000 = P \left(1 + \frac{.16}{4}\right)^{4(5)}$$

$$4563.87 = P$$

3. How long will it take \$250 to double if it is invested at 3.5% interest compounded annually?

$$500 = 250 (1 + .035)^t$$

$$\log 2 = t \log (1.035)$$

$$20.1 \text{ yrs} = t$$

4. Redo #3 if the interest was compounded monthly.

$$500 = 250 \left(1 + \frac{.035}{12}\right)^{12t}$$

$$\log 2 = 12t \log 1.0029$$

$$19.8 \text{ yrs} = t$$

5. The Trusty Bank offers 6% interest compounded monthly and The Savings Bank offers 6.1% interest compounded quarterly. Which bank pays more interest per year?

$$= P \left( 1 + \frac{.06}{12} \right)^{12}$$

$$1.06168 P$$

$$= P \left( 1 + \frac{.061}{4} \right)^4$$

$$= 1.0624 P$$

The Savings Bank

6. \$10,000 is invested at 6.4% interest. Find the value of the investment after one year if the interest is compounded:

a. quarterly

$$\textcircled{a} \quad 10,000 \left( 1 + \frac{.064}{4} \right)^4$$

$$\$10,655.52$$

b. daily

$$\textcircled{b} \quad 10,000 \left( 1 + \frac{.064}{365} \right)^{365}$$

$$\$10,660.86$$

c. hourly

$$\textcircled{c} \quad 10,000 \left( 1 + \frac{.064}{8760} \right)^{8760}$$

$$\$10,660.92$$

d. continuously

$$\textcircled{d} \quad 10,000 e^{.064}$$

$$\$10,660.92$$

7. How long will it take for \$400 to double at 5% compounded continuously?

$$800 = 400 e^{.05t}$$

$$2 = e^{.05t}$$

$$\textcircled{13.9 \text{ yrs} = t}$$

8. How long will it take \$1000 to double at 4% compounded continuously?

$$2 = e^{.04t}$$

$$17.3 = t$$

hrs

9. What is the interest rate if \$500 grows to \$750 in 9 years compounded continuously?

$$750 = 500 e^{9r}$$

$$\ln 1.5 = 9r$$

$$.045 = r$$

$$\textcircled{4.5\%}$$

10. What is the interest rate that will allow \$1000 to grow to \$1500 in 15 years if it compounded continuously?

$$1500 = 1000 e^{15r}$$

$$\ln 1.5 = 15r$$

$$\textcircled{.027} = r$$

$$.027$$

$$\textcircled{2.7\%}$$

$$2.7\%$$